

"Some Practical Aspects of the Smoking-Cancer Problem",  
The New England Journal of Medicine, 3/17/60

Vol. 262 No. 11 SMOKING-CANCER PROBLEM—WYNDER AND HOFFMANN

543

his smoking habits, the data demonstrate that in general smokers who have shifted to filter cigarettes have not significantly changed their consumption of cigarettes. Among the smokers who used to smoke or are still smoking nonfilter cigarettes, 41 per cent complained of definite symptoms, usually a chronic cough. The incidence of these symptoms was found to increase with the number of cigarettes consumed. Among those smoking less than 16 cigarettes per day 15 per cent complained of symptoms associated with smoking, and among those smoking in excess of 20 cigarettes a day 52 per cent had such symptoms. Fifty per cent of the heavy smokers reported regression of symptoms after changing from a nonfilter to a filter cigarette. With more cases at hand one could determine whether this improvement in symptoms is in part a result of the duration of smoking. It appears likely that if the smoker has been smoking heavily for a great many years the changes in his bronchial tree may be irreversible. However, since the study included only men over the age of forty, nearly the entire group had smoked for twenty years.

#### Discussion

For some years our group has been concerned with the marked increase in lung cancer and the related role of cigarette smoking. In 1940 the number of deaths from lung cancer in the United States was 5353 for males and 1626 for females. In 1950 14,922 deaths from lung cancer occurred in males, and 3391 such deaths were reported for females; the figures for 1957 are 26,287 and 4489 respectively. We have often stated that the most effective way to alleviate the problem would be to stop smoking or at least to keep it to a minimum. However, it seems difficult to educate the public effectively in this respect, in part because of the extensive advertising campaign of the tobacco industry to convince it otherwise. We thoroughly encourage, however, present efforts by the American Cancer Society in making available to the public, particularly the youth, data on the potential health hazards of cigarette smoking.

#### Practical Measures

✓ Low-smoke-condensate cigarettes. Although educational efforts must be continued, we are at present concerned with steps that the public might be more willing to accept than to give up smoking. These steps include the reduction of smoke condensate per cigarette, which can be and is being achieved through one or more of the following methods:

- ✓ The use of effective filters, which absorb as much of the smoke condensate as practical.
- The selection of tobacco yielding less smoke condensate.
- The use of less tobacco per cigarette.
- The use of highly porous or perforated cigarette paper.

It is clear from Table 1 that most filter cigarettes are significantly lower in smoke condensate than non-filter cigarettes. There is still considerable variance, however, in the amount of condensate in different types of filter cigarettes — a difference that may not be apparent to the average smoker. The difference in the smoke-condensate content of various American filter cigarettes, however, is less today than it was a year or two ago.

It is estimated that during 1959, 462,700,000,000 cigarettes were sold in the United States.<sup>21</sup> The ten brands that we have tested and recorded in Table 1 account for 83 per cent of the total volume of cigarettes sold. The first two positions (28 per cent of total sales) are still held by nonfilter cigarettes, but the third and fifth positions, as well as the seventh through tenth positions, are held by filter cigarettes. Significant advance in sales has been made in the filter field, as is apparent from the marked increase in the use of filter cigarettes in this country, accounting for less than 10 per cent of total cigarette sales in 1954 and for 50.5 per cent in 1959. The present data show that among the leading filter cigarettes there are several with a content of smoke condensate that is at least a third less than that of the standard, regular, nonfilter cigarette. Similar reductions are obtained by some other filter cigarettes at present not among the leading ten brands, according to Miller and Monahan,<sup>22</sup> with whose determinations our results are in general agreement.

Still lower condensate values have been achieved by the manufacturers of a new group of cigarettes currently being introduced on the American market, such as Duke, Life and Spring. It is too early to tell whether cigarettes with smoke-condensate values at this level will be accepted by the smoker. However, the introduction of such cigarettes by major American tobacco companies is welcome.

A review of the present field indicates that American cigarette manufacturers are gradually lowering the smoke-condensate content of their products. Because of confusing advertising claims the public, however, is not always aware of the facts. It is for this reason that the data as presented in this report and other studies must be made known not only to the medical profession but also to the lay public. It is hoped that the present trend of reducing the smoke condensate and nicotine values of leading American cigarettes will be followed by all major manufacturers of filter cigarettes in the United States. We predict that such a trend will be followed by a significant reduction in diseases associated with the smoking of cigarettes, the extent of which, however, cannot at present be determined.

Butt length. It is clear from this study that the king-size cigarette yields more tar and nicotine than regular-size cigarettes. Claims that tobacco is its own best filter are misleading since it has been shown that

1005072799

the smokers of king-size cigarettes smoke to the same butt length as a smoker of regular-size cigarettes. Thus, since the latter part of the cigarette contains more condensate and nicotine than the first part of the cigarette, the smoker of king-size cigarettes in fact is exposed to more of these substances than the smoker of regular-size cigarettes.<sup>12</sup> A practical suggestion for the smoker, therefore, is that he should not smoke the cigarette to the very butt. He should try to put out his cigarette after consuming it to the halfway mark.

**Puff frequency and inhalation.** Studies evaluating the effect of frequency of puffs indicate that the smoker should not puff too frequently on his cigarette. The smoker should also try not to inhale, or if he must, not so deeply, since most of the smoke condensate is absorbed upon inhalation. It is probably for these reasons that lung cancer is less frequent among cigar and pipe smokers, even though pipe and cigar smoke has been shown to be at least as carcinogenic as cigarette smoke.<sup>23</sup>

**Improvement of smoking symptoms.** All these steps primarily influence the amount of smoke that gets into the smoker's lungs. Some of the suggestions are more practical than others, but all should be seriously considered by the cigarette smoker. The prediction that lowering the amount of smoke condensate in a given cigarette will be followed by a reduction, though not an elimination, of diseases associated with smoking seems already justified in the clinical evaluation of smokers who used to smoke nonfilter cigarettes and who have now shifted to filter cigarettes. From the present study material it cannot be concluded with certainty that there has been no over-all increase in cigarette consumption when a smoker shifts from a plain to a filter cigarette. Certainly, there are some inveterate smokers who do not seem to get much "satisfaction" out of filter cigarettes and therefore may tend to increase the number of cigarettes they consume. The present study suggests that, in general, however, the smoker of filter cigarettes has not significantly increased his consumption of cigarettes. Particularly important is the observation that tends to confirm our clinical experience that half the filter-cigarette smokers who have had symptoms from their smoking stated that these conditions improved after changing to filter cigarettes. This improvement is, of course, chiefly a result of the fact that the filter-cigarette smoker gets less smoke condensate per given puff of cigarette. This improvement of the smoker's reaction becomes especially apparent when the smoker of an effective filter cigarette shifts back to a non-filter cigarette, which he now finds often quite harsh and biting.

**Reduction of carcinogens and co-carcinogens.** Another approach to the problem under discussion is to determine whether we can quantitatively lower the aromatic polycyclic hydrocarbons in tobacco smoke, substances that we consider to be the major initiating

carcinogens in tobacco-smoke condensate.<sup>24</sup> In this connection we have been concentrating on reducing or modifying the combustion temperature of tobacco. As far as reduction of the temperature is concerned, we have so far not been successful in discovering a useful way of accomplishing this. We hold more hope for the possibility of modifying the combustion of tobacco in such a way that fewer aromatic polycyclic hydrocarbons will be formed. Studies must also be carried out in the field of co-carcinogenesis. It is possible that promoting substances such as the phenols can be reduced more efficiently than the initiating carcinogens. It is still too early to tell whether a solution is possible in the general direction of reducing carcinogens or co-carcinogens, but work must be continued in this area.

#### SUMMARY AND CONCLUSIONS

Some practical suggestions that should lead toward reducing the risk of cancer of the respiratory tract among smokers are given. The following measures are suggested: moderation of smoking for those who cannot give up the habit; use of filter cigarettes with the lowest yield of smoke condensate; avoidance of smoking the cigarette to the butt since there is significantly more smoke condensate in the latter part of the cigarette; and not inhaling deeply since such a practice leads to much greater absorption of smoke condensate by the lungs.

The benzo(a)pyrene content of various cigarette-smoke condensates is similar when judged on a gram-for-gram basis. Per cigarette, however, it increases together with an increase in the amount of smoke condensate. Thus, the user of a cigarette with a high yield of smoke condensate will be exposed to more benzo(a)pyrene than one smoking a cigarette with a lower yield.

Filter cigarettes tend to diminish symptoms, especially that of cough, often found to be associated with smoking.

Further research must be carried out in an attempt to reduce carcinogens and co-carcinogens from tobacco-smoke condensate.

#### REFERENCES

1. Burney, L. E. Lung cancer and excessive cigarette smoking: Dr. Little's reply. *CA: Bull. Cancer Progr.* 3:44, 1956.
2. Heller, J. R. If you're worried about cancer — advice from authority. *U. S. News & World Report* 45 (21):60 and 62, May 23, 1959.
3. American Cancer Society. Annual Report 1958. P. 20.
4. Hillelso, H. E. Smoking and health. *The New York Times* (August 22), 1958.
5. Great Britain, Medical Research Council. Tobacco smoking and cancer of lung: official statement. *Brit. M. J.* 1:1523, 1957.
6. *Press Notice* (No. 133). Prepared by Netherlands Minister of Social Affairs and Public Health, The Hague, Netherlands, 1952.
7. Hammond, E. C., and Horn, D. Smoking and death rates — report on forty-four months of follow-up of 187,783 men. I. Total mortality. *J. A.M.A.* 166:1159-1172, 1958. Smoking and death rates — report on forty-four months of follow-up of 187,783 men. II. Death rates by cause. *Ibid.* 166:1211-1246, 1958.
8. Dora, H. F. Tobacco consumption and mortality from cancer and other diseases. *Pub. Health Rep.* 74:501-503, 1959.
9. Doll, R., and Hill, A. B. Lung cancer and other causes of death in relation to smoking: second report on mortality of British doctors. *Brit. M. J.* 2:1071-1081, 1956.

1005072800